# ***Chapter 1 ~ Introduction***

The Great Lakes National Program Office (GLNPO) of the United States Environmental Protection Agency (USEPA) has primary responsibility within the U.S. for conducting surveillance monitoring of the offshore waters of the Great Lakes. This monitoring is intended to fulfill provisions of the Great Lakes Water Quality Agreement (International Joint Commission, 1978) calling for periodic monitoring of the lakes to: 1) assess compliance with jurisdictional control requirements; 2) provide information on non-achievement of agreed-upon water quality objectives; 3) evaluate water quality trends over time; and 4) identify emerging problems in the Great Lakes Basin Ecosystem. GLNPO conducts semi-annual Water Quality Surveys of all five lakes to meet the surveillance monitoring requirements. Each summer GLNPO also conducts an intensive survey of dissolved oxygen (DO) concentrations in Lake Erie. This manual has been prepared by GLNPO to document the sampling and analytical procedures used during the Water Quality Surveys (WQS). The manual acts as a reference for GLNPO and contractor/grantee staff supporting the field, laboratory, and data management activities associated with the survey.

Most of the survey activities are conducted onboard EPA's *R/V Lake Guardian*, a former offshore oil field supply vessel built by Halter Marine, Moss Point, MS, in 1981. Sampling activities aboard the *R/V Lake Guardian* are primarily implemented through the use of:

- a Rosette sampling device deployed from the ship to collect samples for a variety of nutrients, physical parameters, and biological parameters
- tow nets used to collect zooplankton samples, and
- a Ponar grab sampling device used to collect sediment samples for benthic organisms and chemical measurements.

Most of the survey measurements are made on board the ship, either on the bridge or deck (e.g., meteorological measurements such as wind speed and direction, wave height and direction, air temperature, etc.), by the conductivity/temperature/depth (CTD) probe (SeaBird Electronics Inc.), or in the on-ship laboratory (e.g., turbidity, conductivity, pH, etc.). The remaining measurements are made by GLNPO's Great Lakes Analytical Services (GLAS) contractor chemist and biology grantee in land-based laboratories.

The manual is organized into six chapters. **Chapter 1** describes the WQS and includes a Standard Operating Procedure (SOP) for General Shipboard Scientific Operations. This SOP presents information on: 1) roles and responsibilities, 2) the sequence of sampling events, and 3) safety and training. Chapter 1 also includes an SOP for Electronic Field Information Recording. **Chapter 2** provides sampling and analytical procedures for nutrient parameters targeted in the survey. **Chapter 3** provides sampling and analytical procedures for physical parameters including meteorological data and total suspended solids. **Chapter 4** provides sampling and analytical procedures for biological parameters. **Chapter 5** provides analytical procedures for several chemical parameters that are analyzed in the laboratory aboard the *R/V Lake Guardian* ("board chemistry" parameters) including pH, specific conductivity, total alkalinity, turbidity and dissolved oxygen by the Winkler method. **Chapter 6** provides sampling and analytical procedures for nutrients in sediments.

This manual also contains several appendices. **Appendix A** contains maps of the Great Lakes spring and summer survey stations. **Appendix B** contains the quality assurance project plan (QAPP) for the Great Lakes Water Quality Surveys. **Appendix C** contains a staff scheduling form that lists shift dates for proposed and actual GLNPO staff participating in the survey. **Appendix D** contains a QAPP as well as the sampling and analytical procedures used in GLNPO's intensive DO survey of Lake Erie's Central

Basin. **Appendix E** contains survey planning forms that must be submitted by researchers requesting use of the *R/V Lake Guardian* for sampling purposes. **Appendix F** contains the self-certification form that all GLNPO staff and contractors/grantees participating in the survey must complete and provide to the GLNPO QA Manager to certify their meeting pre-survey training requirements as specified on the form. **Appendix G** contains the Medical History Questionnaire that is required to be completed and submitted by all personnel that participate in GLNPO's WQS. **Appendix H** contains hard-copy field information recording forms used to document the data generated during the surveys. **Appendix I** contains lists of acceptable field remark, lab remark, and quality control sample identifier codes used in GLNPO's Great Lakes Environmental Database (GLENDA). **Appendix J** contains a user's manual for the GLENDA remote data entry tool. **Appendix K** includes a list of current GLENDA analyte names and codes for environmental parameters being measured. **Appendix L** contains a list of roles and responsibilities for the Chief Scientist, in addition to a list of priorities for each staffing period and a checklist that must completed by the shift supervisor for each shift of 12 hours and provided to the QA Manager to verify that they met their responsibilities involving ship operations and survey data management. **Appendix M** contains a suggested revision sheet that survey participants should use to document issues, errors, and suggested revisions and clarifications to the manual. **Appendix N** contains a data status tracking sheet to track specific data sets throughout the data verification process and upload to the GLENDA database. **Appendix O** contains a data discrepancy form to initiate a revision to the GLENDA database when errors are identified. **Appendix P** contains a summary of the sample depth's collected as part of the WQS for all five lakes. Finally, **Appendix Q** contains the station location change form that must be completed and approved by pertinent survey participants to finalize a change to a station location.

To facilitate location of all applicable SOPs, a reference table listing the parameters targeted in the study and associated sampling and analytical methods is included in this chapter. The table lists SOPs by method code. Method codes for each SOP can be found in the Table of Contents to the left of the SOP title and in the footer of each SOP.

Because this manual is a dynamic document, an SOP revision sheet has been created and one is located after the introduction to each chapter. The revision sheet is designed to document revisions to each SOP in this manual. In addition, the suggested revisions sheet (Appendix M), also will assist GLNPO in identifying and addressing issues, errors, and suggested revisions and clarifications to the SOPs. With initial development of the manual, revisions have been maintained in summary format.

Earlier revisions of this manual contained: 1) an addendum to the WQS QAPP that provides the information needed to perform the base monitoring program activities on alternate vessels when the *R/V Lake Guardian* is not available (March 2001, Appendix C) and 2) GLNPO's *Standard Operating Procedures for Winter Operations* (March 2001, Appendix F). These documents are available from GLNPO's Document Control Coordinator, in the Policy Coordination and Communications Branch, to support specific projects involving these special circumstances.

Questions concerning this manual should be directed to:
Dr. Glenn Warren
Environmental Monitoring Indicators Team Lead
USEPA Great Lakes National Program Office
Mail Code G-17J
77 West Jackson Boulevard
Chicago, IL 60605
Phone: 312-886-2405
Fax: 312-3532018

***Reference Table***

| WQS Parameter/Activity | Corresponding SOPs |
|---|---|
| General Shipboard Scientific Operations | LG100 |
| Electronic Field Information Recording | LG101 |
| **Nutrients** | |
| Nitrate+Nitrite Nitrogen | LG200 or LG201*, LG203, LG212 |
| Total Phosphorous, Total Dissolved Phosphorous | LG200 or LG201*, LG204, LG212 |
| Chloride, Reactive Silica | LG200 or LG201*, LG205, LG212 |
| Particulate Organic Carbon | LG200 or LG201*, LG206, LG207, LG210 |
| Particulate Nitrogen, Particulate Phosphorous | LG200 or LG201*, LG206, LG208, LG209 |
| Dissolved Organic Carbon | LG200 or LG201*, LG210, LG211 |
| **Physical** | |
| Aesthetics, Temperature-Water, Temperature-Air, Wind Speed, Wind Direction, Wave Height Wave Direction | LG300, LG301 |
| Optical Transmittance | LG301 |
| Total Suspended Solids | LG200 or LG201*, LG302 |
| Dissolved Oxygen | LG301, LG303, LG304 |
| Site Location | LG300 |
| Water Clarity | LG402 |
| **Biological** | |
| Phytoplankton | LG200 or LG201*, LG400, LG401 |
| Zooplankton | LG402, LG403 |
| Chlorophyll *a* | LG200 or LG201*, LG404, LG405 |
| Benthic Invertebrates | LG406, LG407 |
| **Board Chemistry** | |
| Turbidity | LG200 or LG201*, LG500 |
| Specific Conductance | LG200 or LG201*, LG301, LG500 |
| pH | LG200 or LG201*, LG301, LG500 |
| Alkalinity | LG200 or LG201*, LG500 |
| Dissolved Oxygen (Winkler Method) | LG200 or LG201*, LG501 |
| **Nutrients in Sediment** | |
| Total Phosphorous | LG600 |
| Total Organic Carbon | LG601 |
| Total Nitrogen | LG602 |

* LG201 when Rosette is not operational

**Lake Guardian Scientific Check List**

To be filled out by chief scientist during SOP traning or survey preperation

## Chemicals

- ☐ Turbidity Calibration and Check Standards (1 set per year)
- ☐ pH Calibration Standards (2 packs per year)
- ☐ pH powdered Check Standards
- ☐ Alkalinity Check Standards
- ☐ Conductivity Calibration and Check Standards
- ☐ Sulfuric Acid (concentrated, 30% solution volume by volume, and 0.02 N)
- ☐ 1:1 Nitric acid for cations
- ☐ Manganous Sulfate
- ☐ Alkaline Iodide
- ☐ Sodium Thiosulfate
- ☐ Starch solution
- ☐ Triton X

## Equipment Check

- ☐ pH Meter and Probe
- ☐ pH Meter and Probe for Alkalinity
- ☐ Back up pH meter and probes (probe should be less than 2 years old)
- ☐ Conductivity Meter and Probe
- ☐ Back up Conductivity Probe
- ☐ Turbidity meter
- ☐ Temperature probe
- ☐ Back up Temperature probe
- ☐ Electric Titrator (Winkler DO)
- ☐ Burette system for alkalinity
- ☐ Back up Burette for alkalinity
- ☐ Filtering station
- ☐ Heater for conductivity analysis
- ☐ Back up Heater with Multiple voltage power supplier
- ☐ Sample stirrers

## Supplies

- ☐ Cubitainers (4L) & caps
- ☐ 125mL bottles & caps for nutrients
- ☐ 250mL bottles & caps for metals
- ☐ Cuvettes (10mL) for chlorophyll
- ☐ 500-1000 (1mL) bottles & caps
- ☐ GFF (Glass fiber fine) filters for chlorophyll
- ☐ Sartorius 0.45 µm membrane filters
- ☐ Gloves (make sure that all sizes are on ship)

## To be brought to ship prior to leaving for survey

☐ Field recording sheets

1) Survey Information
2) Station Information
3) Rosette data
4) Ponar grab data
5)Zooplankton flowmeter cal.
6)Zooplankton & Secchi data
7) Chlorophlly a prep
8) Phytoplankton
9) Nutrient prep.
9) Nutrient prep.
10) POC, PN, PP prep.
11) TSS prep.
12) Prep. QA Samples
13) Cal. Data Board Chem.
14) Control Standards data Board Chem.
15) Board Chem. data
16) D.O. data Winkler

- ☐ Labels for cubitainers and bottles (Color coded)
- ☐ Coolers for sample storage
- ☐ (2) Empty 5 gallon Liquid waste containers

Name_____ Date _____

Revision Sheet

| Method Number | SOP Title | New Revision Number | Description of Changes | Updated Revision Number and Date on SOP/TOC | | | Date | Initials of Person Responsible for Changes | Approval Signature |
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